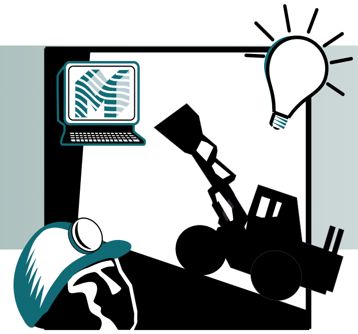
MINING

Project Fact Sheet



Drilling and Blasting Optimization

Benefits

- Reduces energy requirements in downstream processes by allowing better control of rock fragmentation
- Reduces cost of downstream processing by increasing process plant throughput
- Reduces the amounts of mineral ore in waste piles
- Improves mine safety by increasing wall stability and minimizing flyrock
- Minimizes blast vibration and the potential for damage to structures near the mine

Application

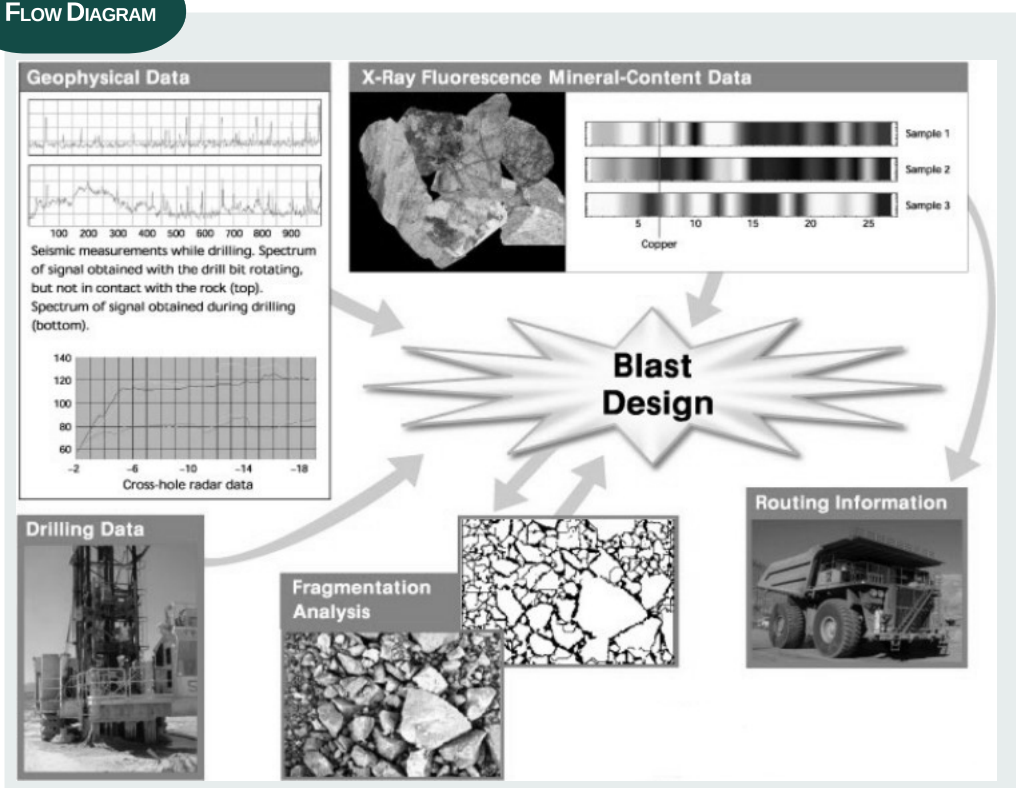
Optimized drilling and blasting can be utilized in surface mining.

Optimized design reduces energy needs in downstream mineral processing

Optimization of drilling and blasting using geophysical analysis will result in better control of rock fragmentation. Use of x-ray fluorescence spectroscopy will allow downhole mapping of mineral content, which will minimize waste and dilution. Use of these technologies will reduce the energy used during grinding and crushing, and will lower the cost of mineral processing.

Characterizing fractures and other discontinuities in the rock mass is one of the most important inputs to blast design to achieve optimal rock fragmentation. Development of sensors, data acquisition systems, and analysis tools will allow real-time geophysical characterization of the rock mass during drilling. Development of an on-line system to measure mineral content in the borehole will allow miners to know the exact location of waste rock, rock to be milled, and rock to be leached. This information can be used to minimize the amount of dilution that occurs during blasting and subsequent mucking and hauling.

Flow Diagram



Flow diagram showing the data inputs into blast design.

Project Description

Objective: Integrate geophysical and x-ray fluorescence (XRF) data with drilling data to create an adaptive, online analysis tool to optimize subsequent drilling and blasting.

This research will develop real-time sensors and data acquisition systems to increase and better quantify data obtained during drilling, and integrate the data collected during drilling into an analysis tool that can be used to help optimize subsequent drilling and blasting. Specifically, the three technical targets are development and implementation of: 1) a prototype measurements-while-drilling geophysical field system to characterize the rock mass surrounding the borehole; 2) a prototype system to make real-time measurements of mineral content in the borehole; and 3) an on-line, adaptive, blast design tool based on analysis of data collected during drilling.

Progress and Milestones

This project completed the following activities:

- Completed first and second round of field tests
- Developed acoustic system for online analysis of drill vibration data for fracture-zone characterization
- Built and field tested prototype system that allows continuous sampling of dust/cuttings on the drill rig during drilling
- Analyzed more than 100 rock samples by x-ray fluorescence spectroscopy to determine mineral content
- Completed pre-blast rock-mass characterization and post-blast fragmentation analysis of field-test data to develop initial blast model
- Integrated and analyzed blast-hole data, drilling data (torque, down-hole pressure, penetration rate, and rotation speed vs. depth), blasting parameters (hole energy, layout, timing), and data from the Split system installed at the primary crusher

This project involves the following activities:

- Develop refined blast model
- Develop field prototype x-ray-fluorescence mineral-content sensor
- Develop geophysical rock-mass characterization field system along with data-acquisition system and post-processing algorithms
- Perform pre-blast rock mass characterization and post-blast fragmentation analysis of full-scale field test
- Develop online Adaptive Surface Blast Design System

PROJECT PARTNERS

Lawrence Berkeley National Laboratory
Berkeley, CA

Phelps Dodge Mining Company
Morenci, AZ

Split Engineering
Tucson, AZ

University of Arizona
Tucson, AZ

Aquila Mining Systems Ltd.
Montréal, Canada

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Office of Industrial Technologies
Clearinghouse
Phone: (800) 862-2086
Fax: (360) 586-8303
clearinghouse@ee.doe.gov

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www.oit.doe.gov/mining

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

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